a first barrier layer;

a quantum well;

a second barrier layer that is a transfer barrier layer;

an electron storage layer;

a third barrier layer;

and an etching up to the level of the transfer barrier layer so as to make the first ohmic contact extending up to the quantum well and the second ohmic contact extending up the electron storage layer.

cont. A3

23. (New) An electromagnetic wave detector according to claim 13, further comprising a resetting unit configured to reset the flow of the electrons in the storage layer.

24. (New) An electromagnetic wave detector according to claim 13, comprising third and fourth contacts located on either side of the stack of layers of semiconductor materials.

REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-24 are presently pending in the present application. Claims 1- 9 and 11 have been amended, and Claims 13-24 have been added by the present amendment.

In the outstanding Office Action, Claims 4, 5 and 7-10 were withdrawn from further consideration; the drawings were objected to; Claims 1 and 2 were rejected under 35 U.S.C. § 112, second paragraph; Claims 1 and 6 were objected to; Claims 1, 2, 3 and 11 were rejected under 35 U.S.C. § 103(a) as unpatentable over Rosencher et al in view of Katoh; and Claims 6 and 12 were rejected under 35 U.S.C. § 103(a) as unpatentable over Rosencher et al and Katoh in view of Nanbu.

Regarding the objection to the drawings, enclosed is a separate Letter Requesting Approval of Drawing Changes for labeling Figures 1a and 1b "Prior Art" as suggested by the Examiner.

Regarding the rejection of Claims 1, 2, 3, and 6 under 35 U.S.C. § 112, second paragraph, Claims 1, 2, 3 and 6 have been amended in light of the comments noted in the outstanding Office Action and to correct minor informalities. Accordingly, it is respectfully requested this rejection be withdrawn.

Claims 1, 2, 3 and 11 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Rosencher et al in view of Katoh. This rejection is respectfully traversed.

Amended Claim 1 is directed to an electromagnetic wave detector having a stack of layers made of semiconductor materials. The electromagnetic wave detector has a quantum well and an electron storage layer separated by a transfer barrier layer. The thickness of the transfer barrier layer is one order of magnitude greater than a thickness of the quantum well. Further, a lowest energy level of a conduction band of the transfer barrier layer is greater than energy levels of the quantum well and the electron storage layer. Moreover, the transfer barrier layer has a conduction band profile that decreases from the quantum well towards the electron storage layer. For example, as shown in Figure 3, the transfer barrier layer has a conduction band profile that decreases from the quantum well towards the electron storage layer.

The outstanding Office Action states Rosencher et al teach a thickness of the transfer barrier layer which is about one order of magnitude greater than a thickness of the quantum well and cites Figure 4. However, according to Figure 4, the thickness of the transfer barrier layer is about 200Å and the thickness of the quantum well is about 100Å. Therefore, the thickness of the transfer barrier layer is double the thickness of the quantum well. On the

contrary, the present invention recites the thickness of the transfer barrier layer is one order of magnitude greater than a thickness of the quantum well (not double the thickness as in Rosencher et al).

Further, Katoh discloses a heterojunction bipolar transistor with a conduction band profile that has a flat value for an emitter, a changing value from the emitter towards a collector over a base and a flat value over the collector. In more detail, Katoh discloses, for example in Figure 1, a plurality of semiconductor layers forming an emitter, another plurality of semiconductor layers forming a base, and another plurality of semiconductor layers forming a collector. The thickness of the collector is 10,000Å, the thickness of the base is 1,000Å and the thickness of the emitter is 1,200Å.[1] However, contrary to the Applicants' invention, Katoh does not teach a transfer barrier layer having a thickness about one order of magnitude greater than the thickness of the electron storage layer and the quantum well.

Accordingly, any combination of the above references does not teach or suggest the claimed invention. Therefore, it is respectfully requested this rejection be withdrawn.

Claims 6 and 12 stand rejected under 35 U.S.C. §103(a) as unpatentable over Rosencher et al and Katoh in view of Nanbu. This rejection is respectfully traversed.

Claims 6 and 12 depend on independent Claim 1, which as discussed above is believed to be allowable. Further, Nambu also does not disclose a transfer barrier layer having a thickness about one order of magnitude larger than the thickness of the quantum well. Accordingly, it is respectfully submitted Claims 6 and 12 are also allowable.

In addition, new Claims 13-24 have been added to set forth the invention in a varying scope and Applicants submit the new claims are supported by the originally filed specification. In particular, new Claims 13-24 are similar to Claims 1-12, respectively, but

[1]Katoh, column 6, line 48 to column 7, line 23.

have been drafted to not use means-plus-function terminology. It is respectfully submitted new Claims 13-24 are allowable for similar reasons as discussed above.

Consequently, in light of the above discussion in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable Action to that effect is respectfully requested.

Respectfully submitted,

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IN THE CLAIMS

Please amend Claims 1- 9 and 11 as follows:

--1. (Amended) An electromagnetic wave detector comprising:

a stack of layers made of III-V semiconductor materials, [the] a conduction band profile of said materials defining at least one quantum well, said quantum well having at least one first discrete energy level populated with electrons that are capable of passing to a second energy level under [the] an absorption of an electromagnetic wave; and

means for [the reading of] counting said electrons in the second energy level,

wherein the stack of layers of semiconductor materials furthermore comprises a transfer barrier layer, and an electron storage layer separated from the quantum well by [a] the transfer barrier layer, and

wherein [the] a thickness of the transfer barrier layer [being] is about one order of magnitude greater than [the] a thickness of the quantum well, [the lower] a lowest energy level of [the] a conduction band of the transfer barrier layer [being] is greater than [those] energy levels of the quantum well and the electron storage layer, and [decreasing] the conduction band profile of the stack of layers of semiconductor materials decreases from the quantum well to the electron storage layer so as to further [the] a flow of electrons from the second energy [state] level to the electron storage layer.

2. (Amended) An electromagnetic wave detector according to claim 1, wherein the stack of layers made of III-V semiconductor materials furthermore comprises:

a first barrier layer; and

a third barrier layer, both of the first and third layers being made of semiconductor materials such that [the lower] a lowest energy level of [their] a conduction band of said both layers is respectively greater than [the lower] a lowest energy [levels] level of the conduction band of the quantum well and of the electron storage layer.

3. (Amended) An electromagnetic wave detector according to claim 1, wherein [the] a decreasing profile of the [lower] lowest energy level of the conduction band of the transfer barrier layer is obtained with a semiconductor alloy [whose] having a composition [varies] varying from the quantum well [up] to the electron storage layer.

4. (Amended) An electromagnetic wave detector according to claim 1, wherein the decreasing profile of the [lower] lowest energy level of the conduction band of the transfer barrier layer is obtained by [the] a presence, in the stack of layers made of semiconductor materials, of a piezoelectric semiconductor material creating a natural electrical field.

5. (Amended) An electromagnetic wave detector according to claim 1, wherein the stack of layers made of semiconductor materials comprises a first layer and a second layer of doped semiconductor materials on either side of the unit constituted by the electron storage layer/transfer barrier/quantum well so as to enable [the] a creation of an electric field responsible for the decreasing profile of the [lower] lowest energy level of the conduction band of the transfer barrier layer.

6. (Amended) An electromagnetic wave detector according to [one] claim 1, wherein the [means of reading electrons in the second energy level comprise] counting means comprises:

a first ohmic contact; and

a second ohmic contact, both of the first and second ohmic contacts being located at the electron storage layer so as to carry out a measurement of photocurrent in [the] a plane of the storage layer.

7. (Amended) An electromagnetic wave detector according to claim 5, further comprising the following stack of layers of semiconductor materials, starting from [the] a surface of a semiconductor substrate:

[-] a first barrier layer;

[-] a quantum well;

[-] a second barrier layer that is a transfer barrier layer;

[-] an electron storage layer;

[-] a third barrier layer;

the first and second ohmic contacts extending from the third barrier layer up to the electron storage layer.

8. (Amended) An electromagnetic wave detector according to claim 6, comprising the following stack of layers of semiconductor materials, starting from [the] a surface of a semiconductor substrate:

[-] a third barrier layer;

[-] an electron storage layer;

[-] a second barrier layer that is a transfer barrier layer;

[-] an electron storage layer;

[-] a first barrier layer;

and a mesa defined in:

[-] the transfer barrier layer;

[-] the quantum well;

[-] the first barrier layer;

the first and second ohmic contacts being located on either side of the mesa.

9. (Amended) An electromagnetic wave detector according to claim 1, wherein the means for [the reading of the] counting electrons in the second energy level comprise a first ohmic contact and a second ohmic contact located respectively in the quantum well and in the electron storage layer so as to carry out a photovoltaic reading of [the] a voltage set up between [the] electrons of the quantum well and [the] electrons of the storage well.

11. (Amended) An electromagnetic wave detector according to claim 1, further comprising means [to reset] for resetting the flow of the electrons in the storage layer.--

13 -24 (New).